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LA RECHERCHE AGRONOMIQUE
POUR LE DÉVELOPPEMENT

Climate Change
Why is it so important?

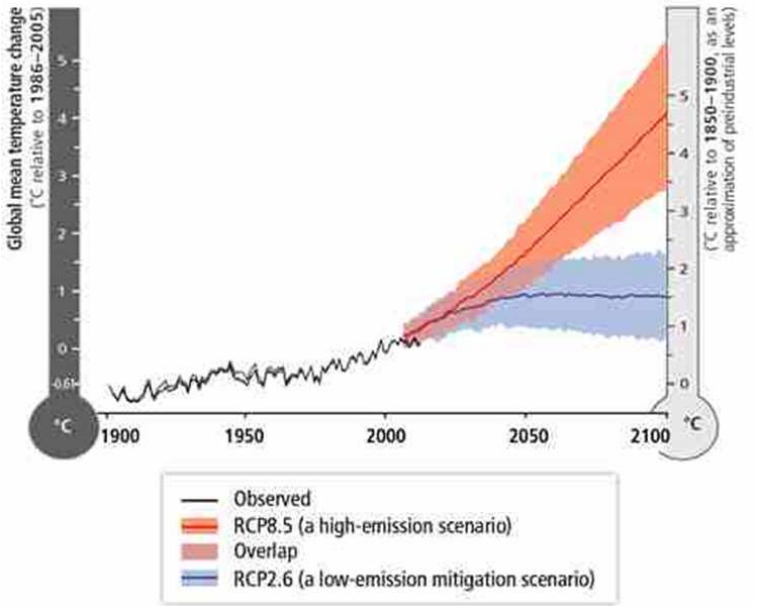
Alain RIVAL
Indonesia-France Seminar
Makassar, Sulawesi
December 1-3, 2014

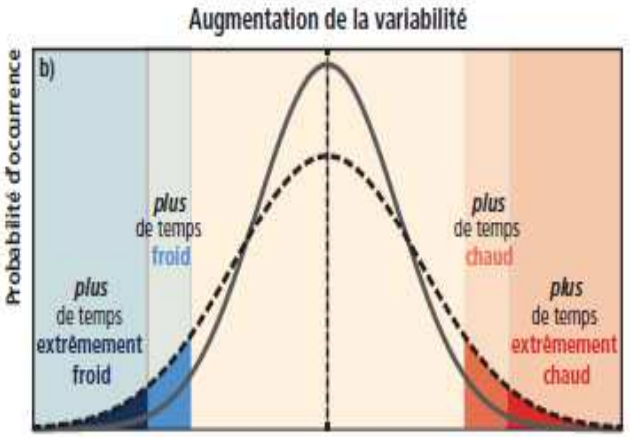
What climatic changes are expected ?

1 Changes in climatic trends

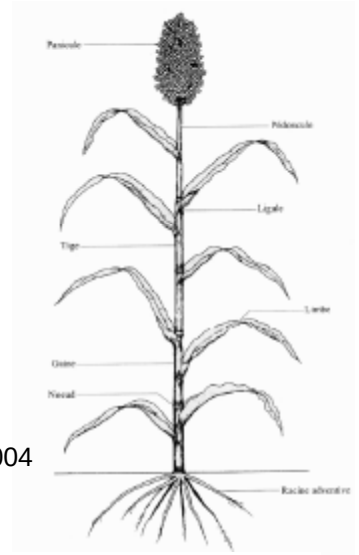
2 Extreme Climatic Events

3 Seasonal and inter-annual variability





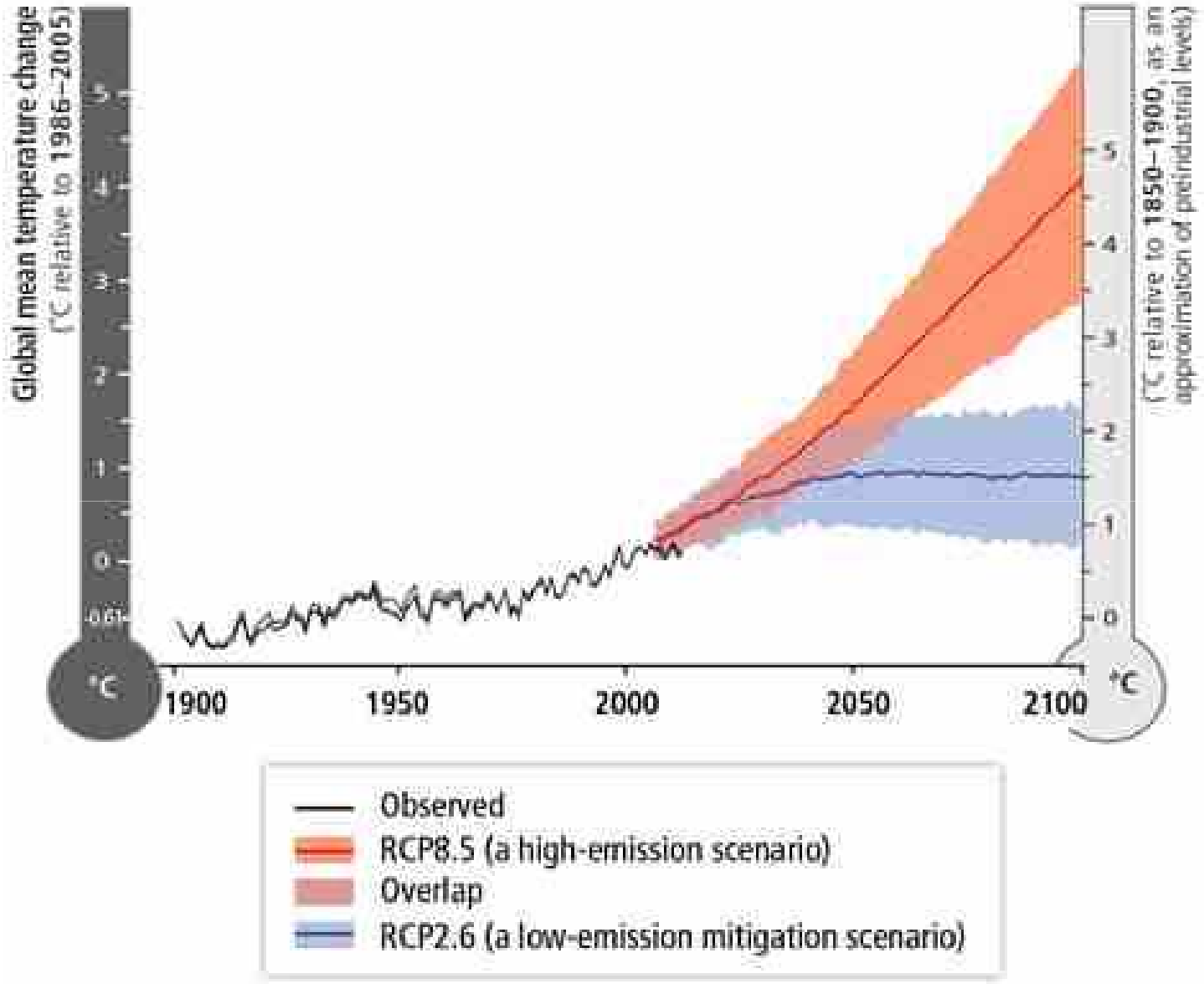
(Bréda, 2014); thanks to Th Caquet



Clerget 2004

Photoperiodism in African sorghum:

Flowering is synchronous with ending of rainy season


Global mean temperature change
(°C relative to 1986–2005)
5
4
3
2
1
0
-0.61
°C
1900
1950
2000
2050
2100
°C
(°C relative to 1850–1900, as an approximation of preindustrial levels)
5
4
3
2
1
0
Observed
RCP8.5 (a high-emission scenario)
Overlap
RCP2.6 (a low-emission mitigation scenario)

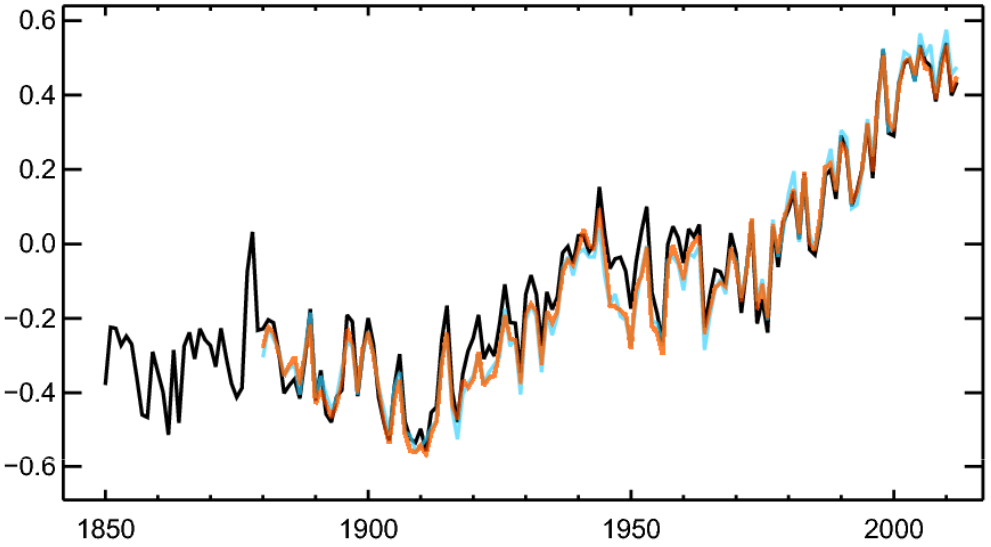
Quizz

The average increase in temperature on the surface of the earth from 1880 to 2012 was approximately of :

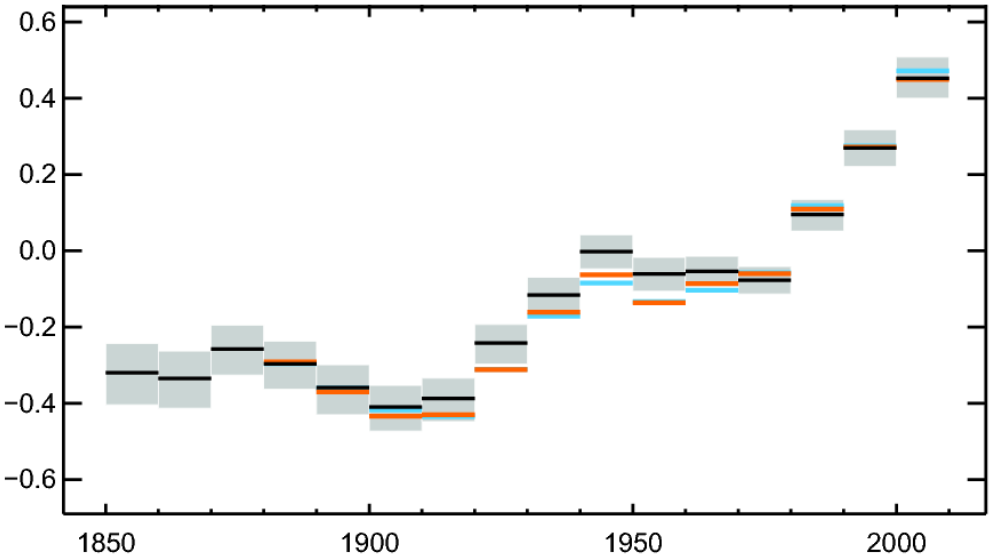
- A. 0,85 ± 0,2° C
- B. 8,5 ± 1,8° C
- C. 0,08 ± 0,018 ° C

Answer: **A** (IPCC 2014)

Changes in global average surface temperature relative to 1961-1990 (APCC, 2013)



Average yearly temperatures



Decennial average temperatures

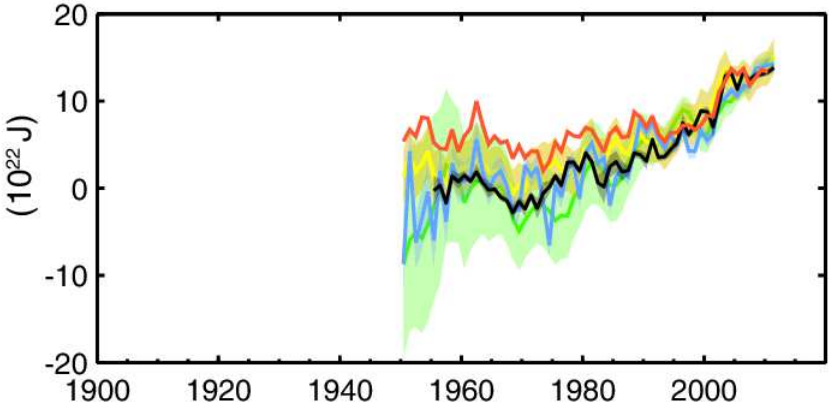
Quizz

Rising of sea level between 1901 and 2010 was

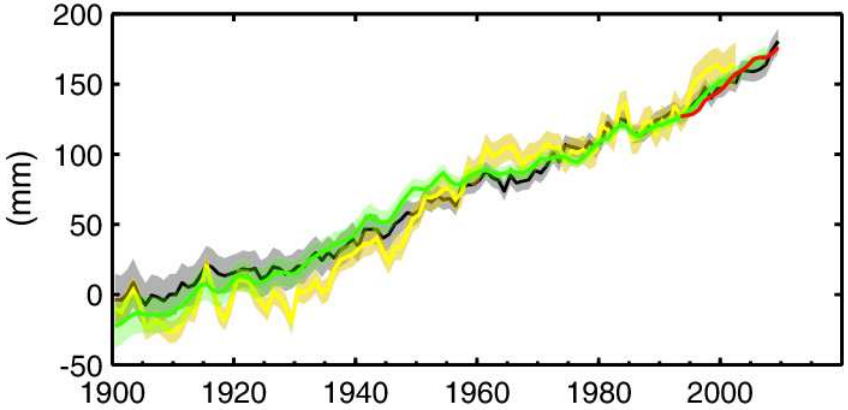
- A. 19 mm
- B. 19 cm
- C. 1,9 mm

Answer : B (IPCC 2014)

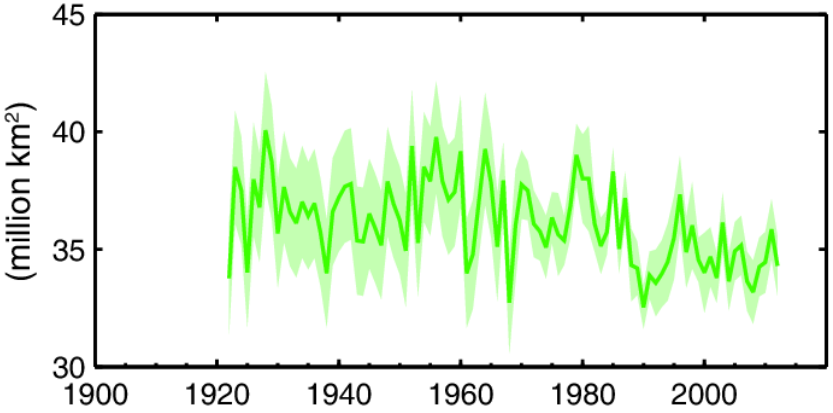
Evolutions in the ocean and cryosphere since the early twentieth century (IPCC, 2013)



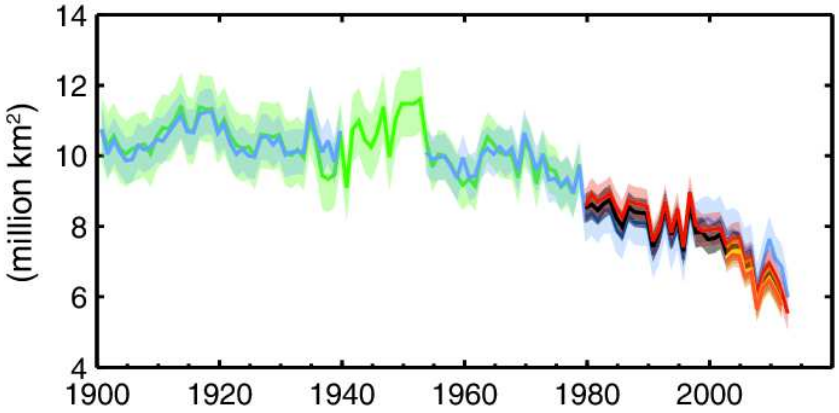
Surface calorific content in oceans (0-700m)



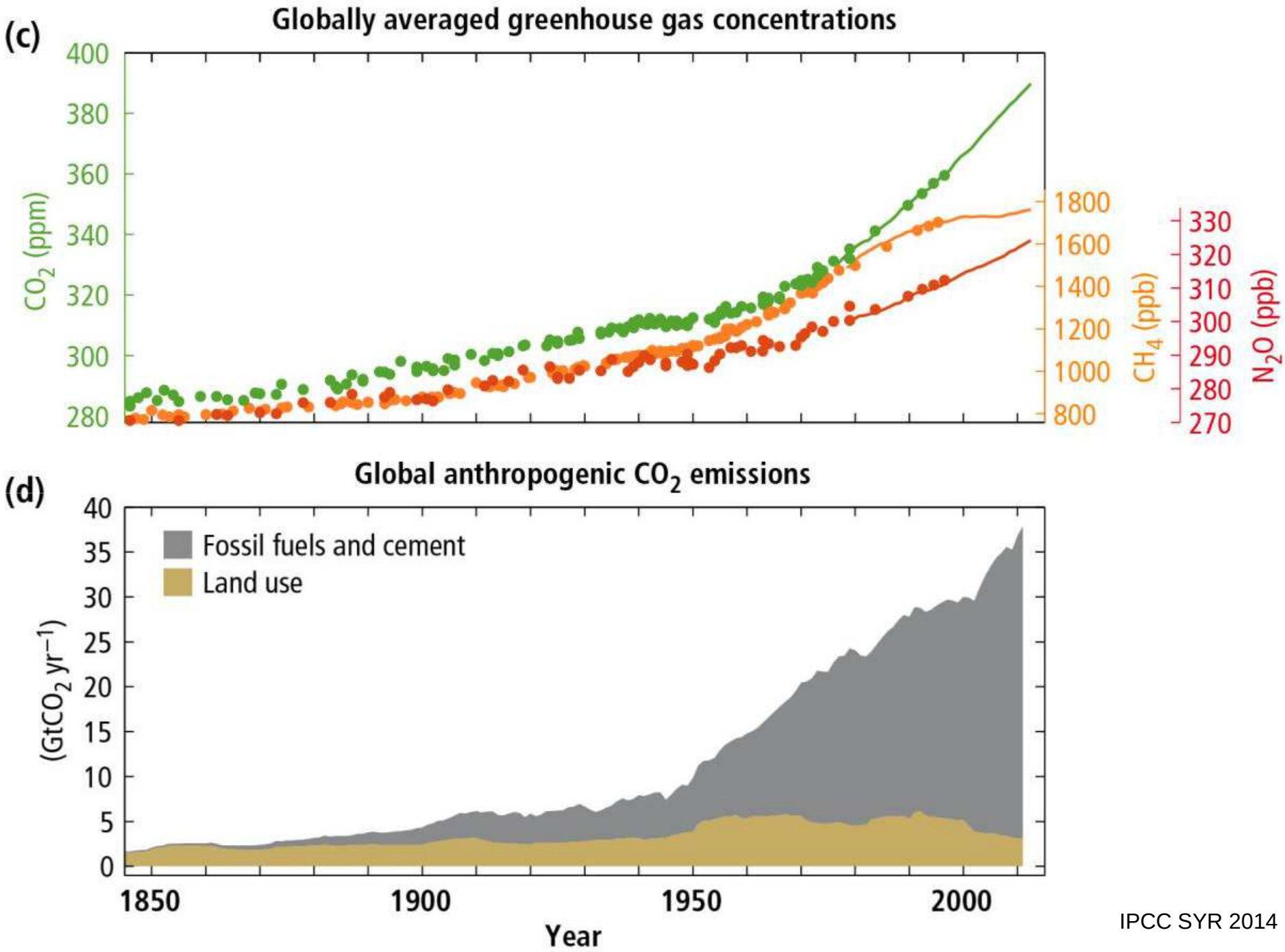
Average sea level 1900-1905



Snow cover in Spring (NH)

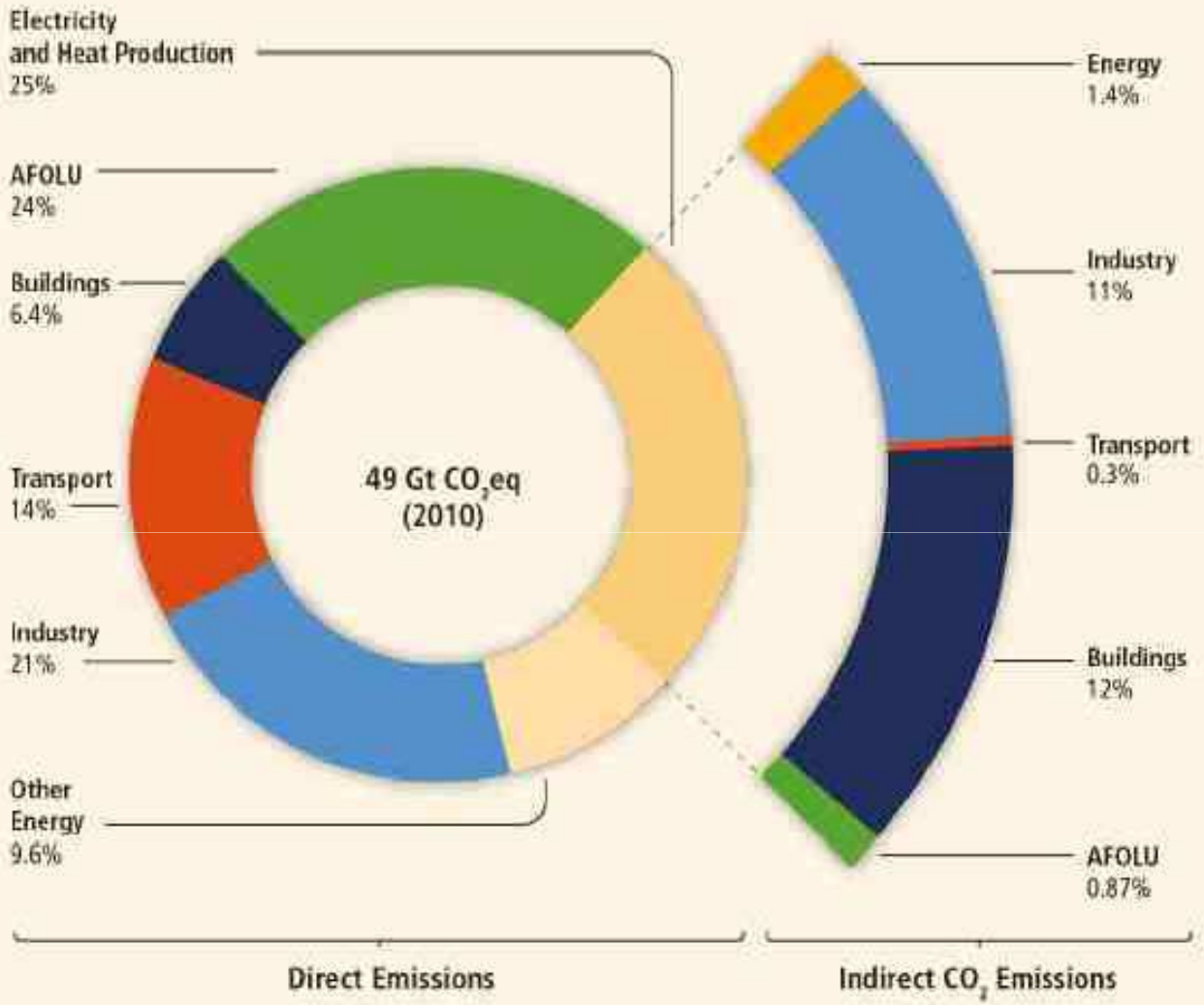


Extension of Arctic sea ice in summer



IPCC SYR 2014

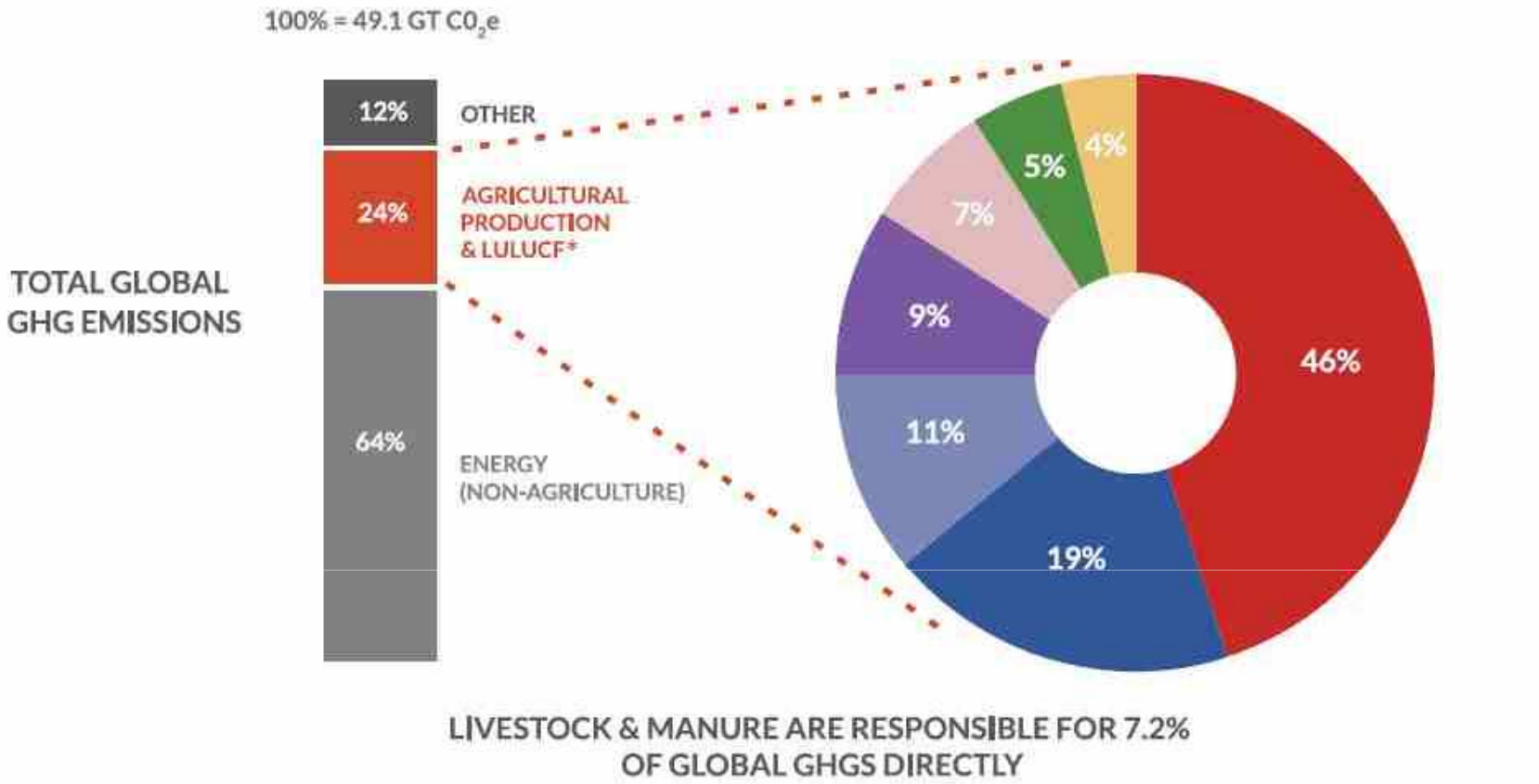
Greenhouse Gas Emissions by Economic Sectors



IPCC 2014

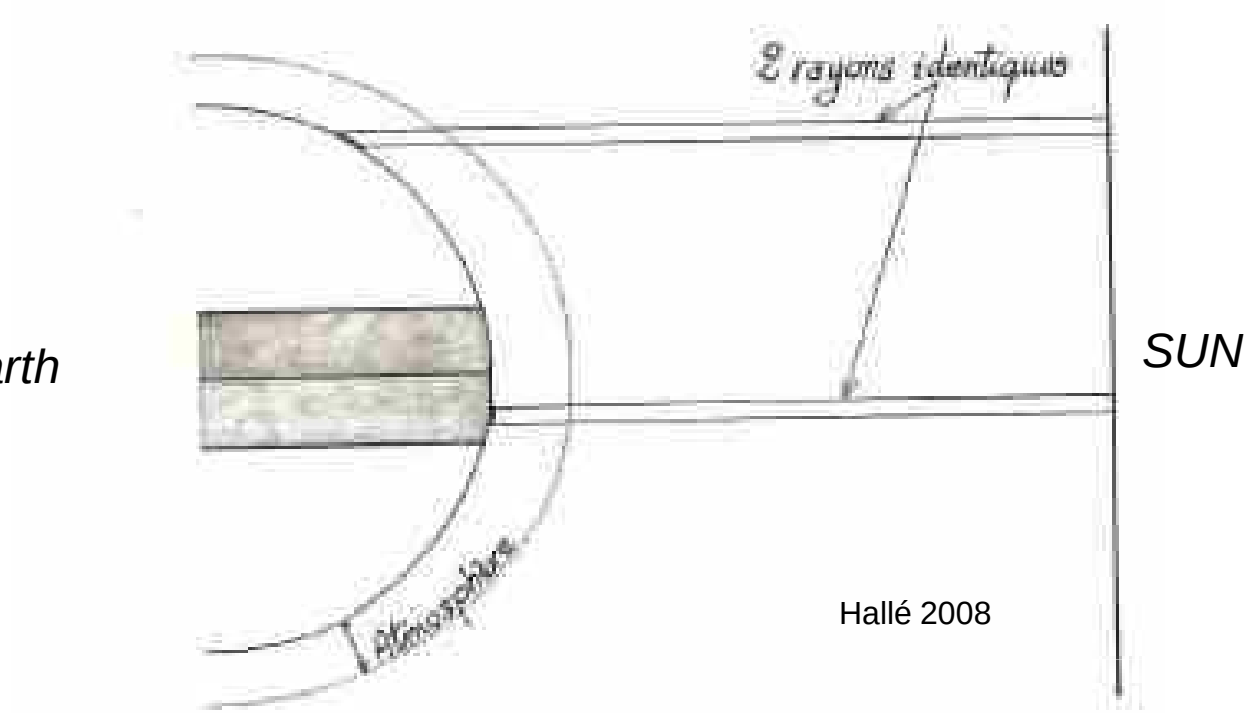
48. *"Hé ! l'ami ! Ne coupe pas cet arbre ! Nous en avons besoin pour nous protéger contre l'effet de serre !"*

Global AFOLU greenhouse gas emissions by sub-sector, 2010.



Source: World Resources Institute analysis based on UNEP, 2012; FAO, 2012; EIA, 2012; IEA, 2012; and Houghton, 2008, with adjustments.[31] ** Land Use, Land-Use Change and Forestry (LULUCF)*

The Tropical Climate



- Earth to Sun distance
- Angle of incidence of the sun
- Day length (photoperiod)
- Diurnal temperature higher than the annual average amplitude

It is simplistic to say that the tropical climate is hot
In altitude the climate of the area is also a tropical climate!

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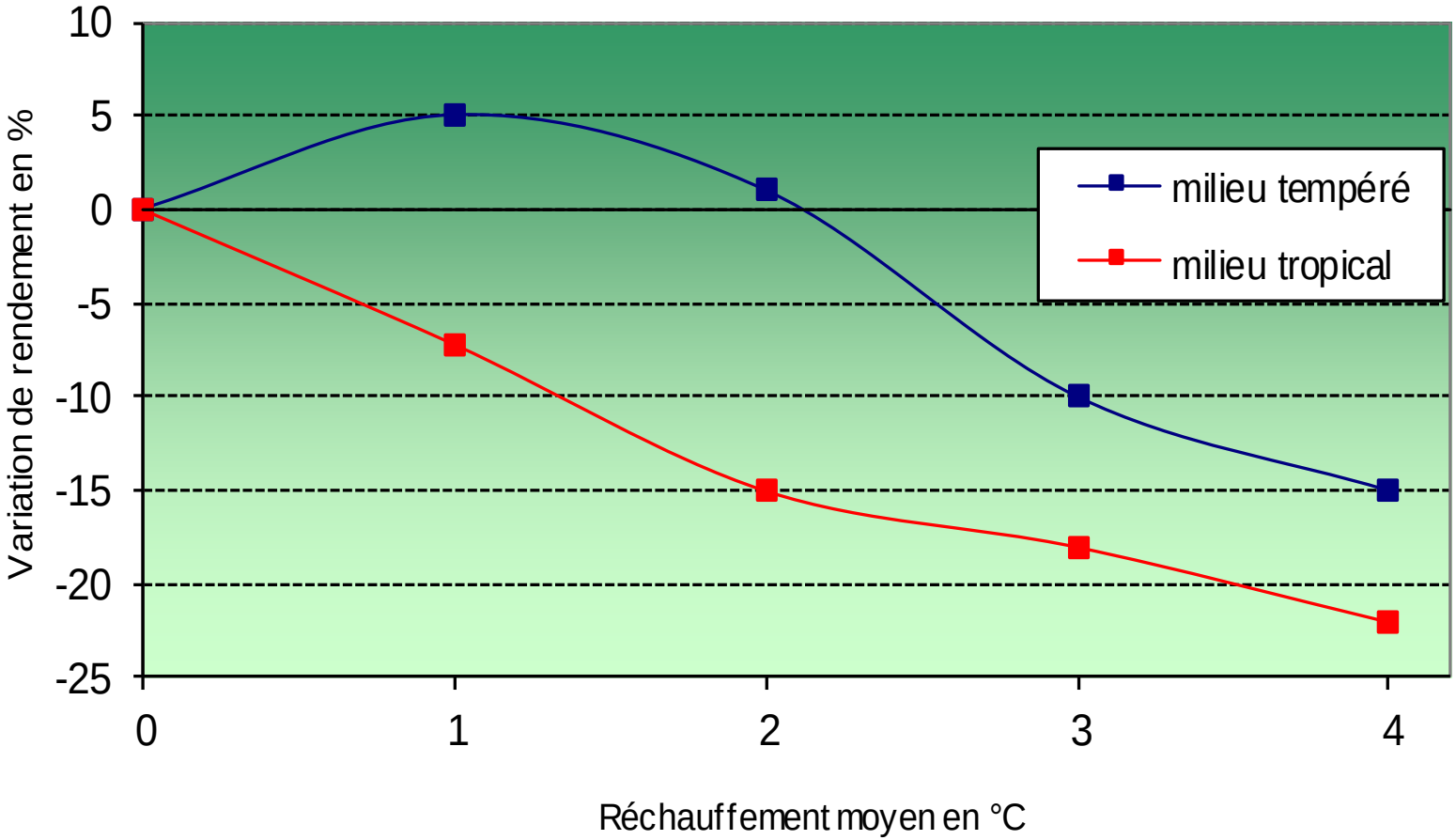
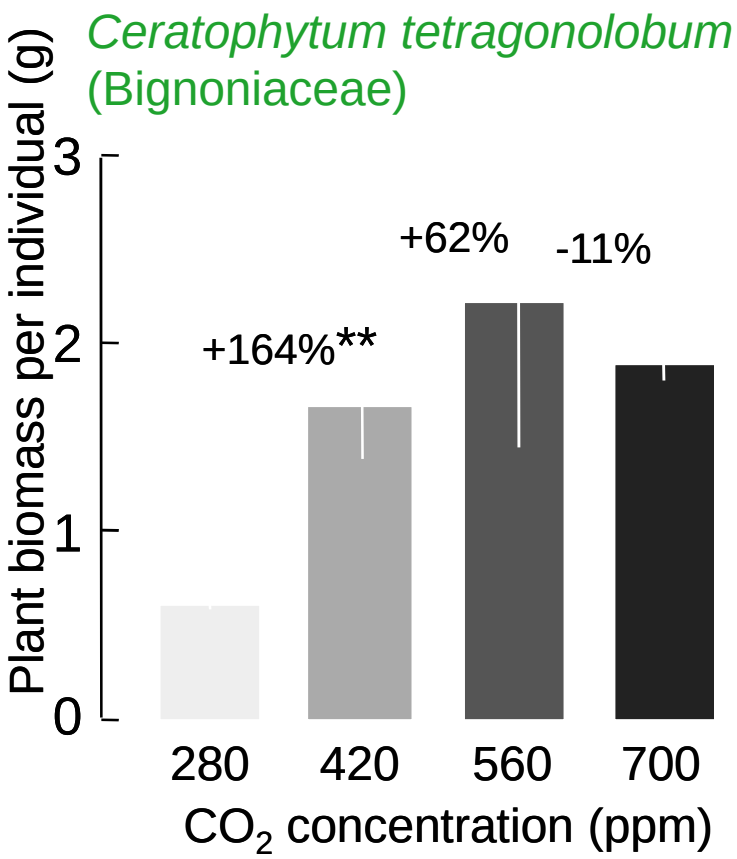
Global warming has not the same impact on yields



Merci à E. Cloppet (Météo-France)

Under elevated CO_2 vines are likely to accelerate tropical forest dynamics and reduce carbon stocks



J Granados & Ch Körner (2002)
Glob Change Biol 8:1109

Merci à J. Weber

Climate change and pathogens

Development of the coffee rust is sensitive to temperature and moisture variations

Climate change and animal vector-borne diseases. Studies on risk of transmission of Nile fever by mosquitoes

Climate-Smart Agriculture
The basics

1. Sustainable increases in agricultural production and farmers' income (food safety)

2. Adaptation (and resilience) to climate change

3. Mitigating climate change by reducing emissions of greenhouse gases and carbon sequestration

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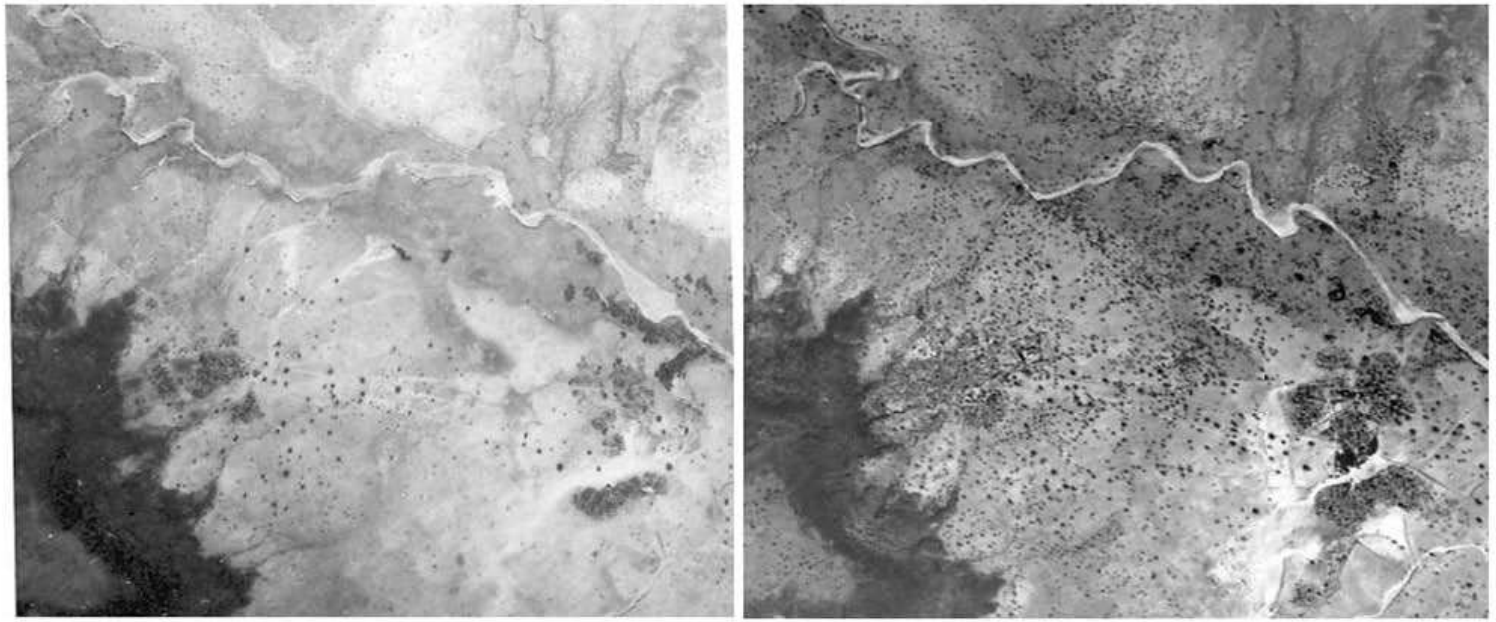
Climate Smart Agriculture at work

- In Niger: the natural regeneration of trees (agroforestry) assisted by farmers

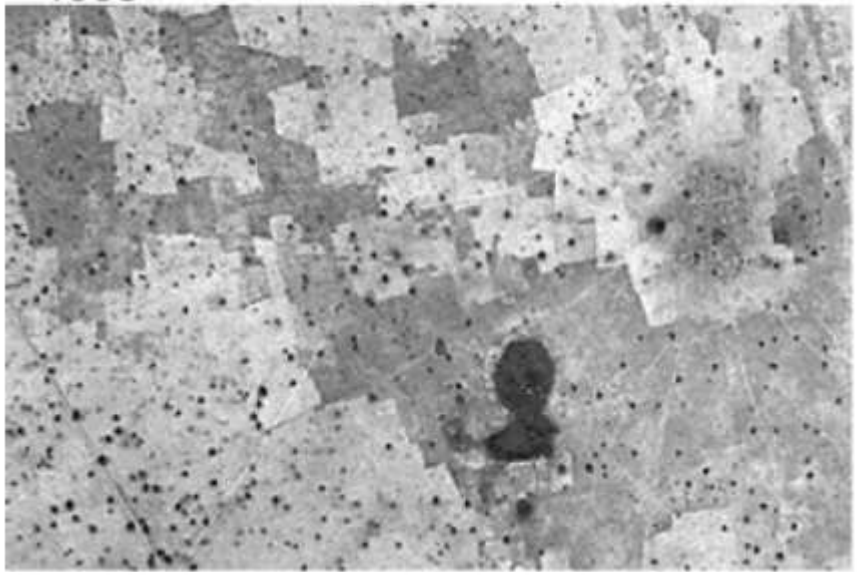


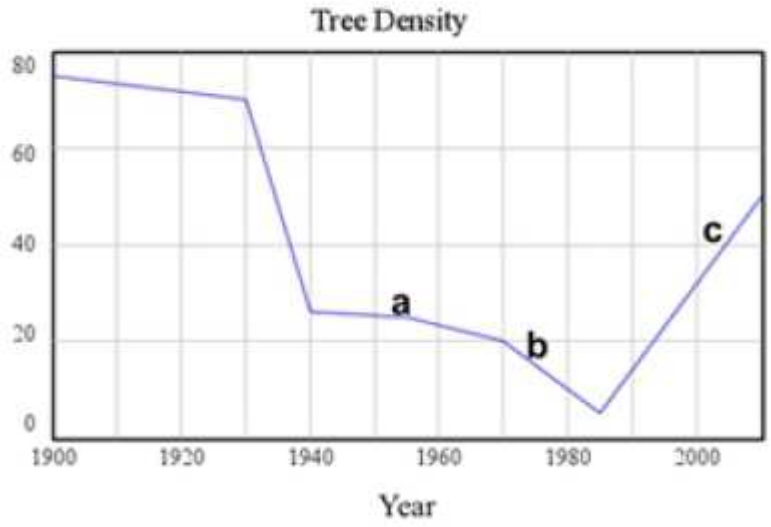
1975 2003

Source: World Vision Australia

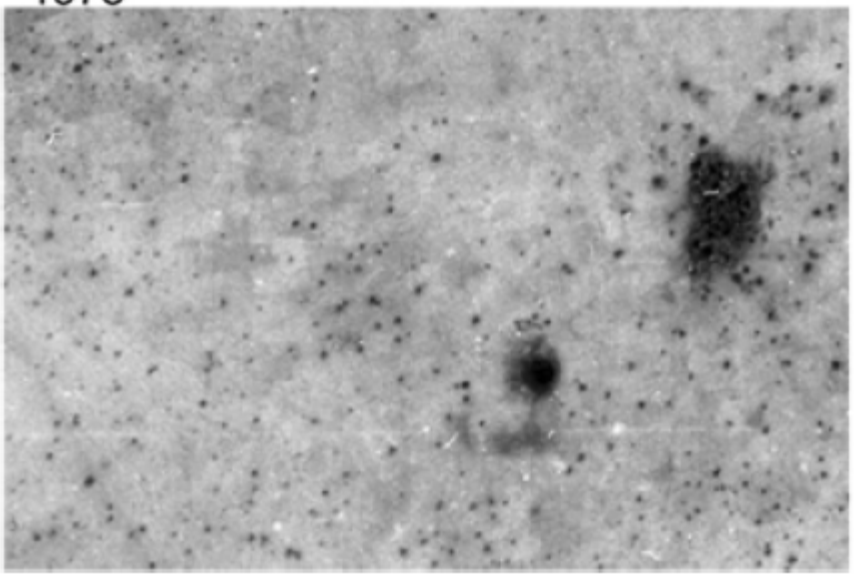
Tree cover in fields in Zinder, Niger

1955

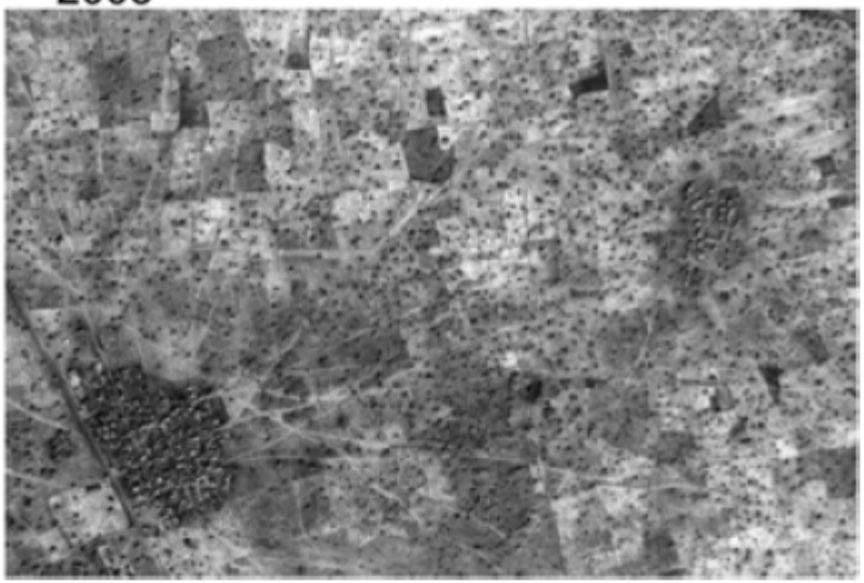




1975



2005

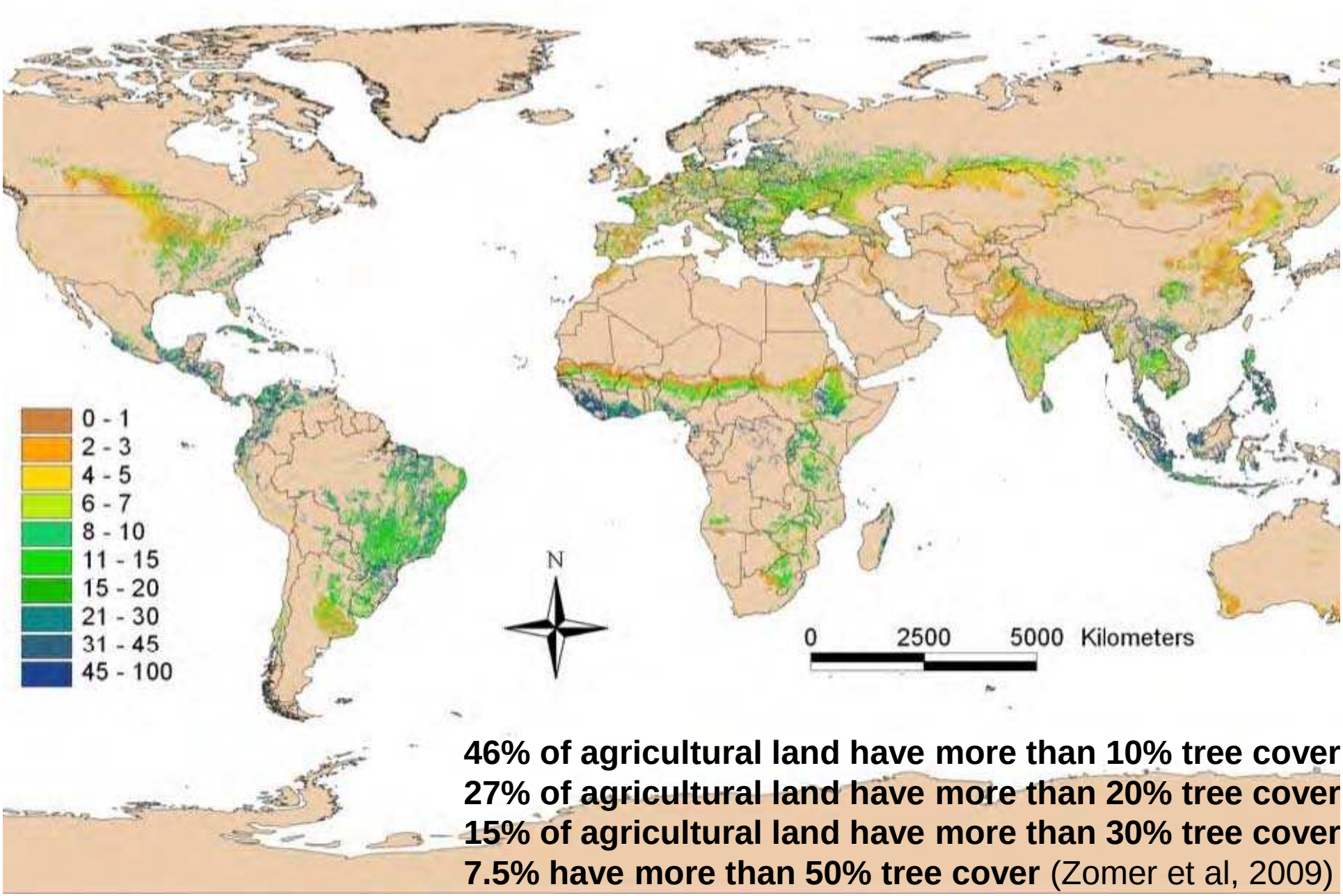


(Sendzimir et al. Ecology & Society 2011)

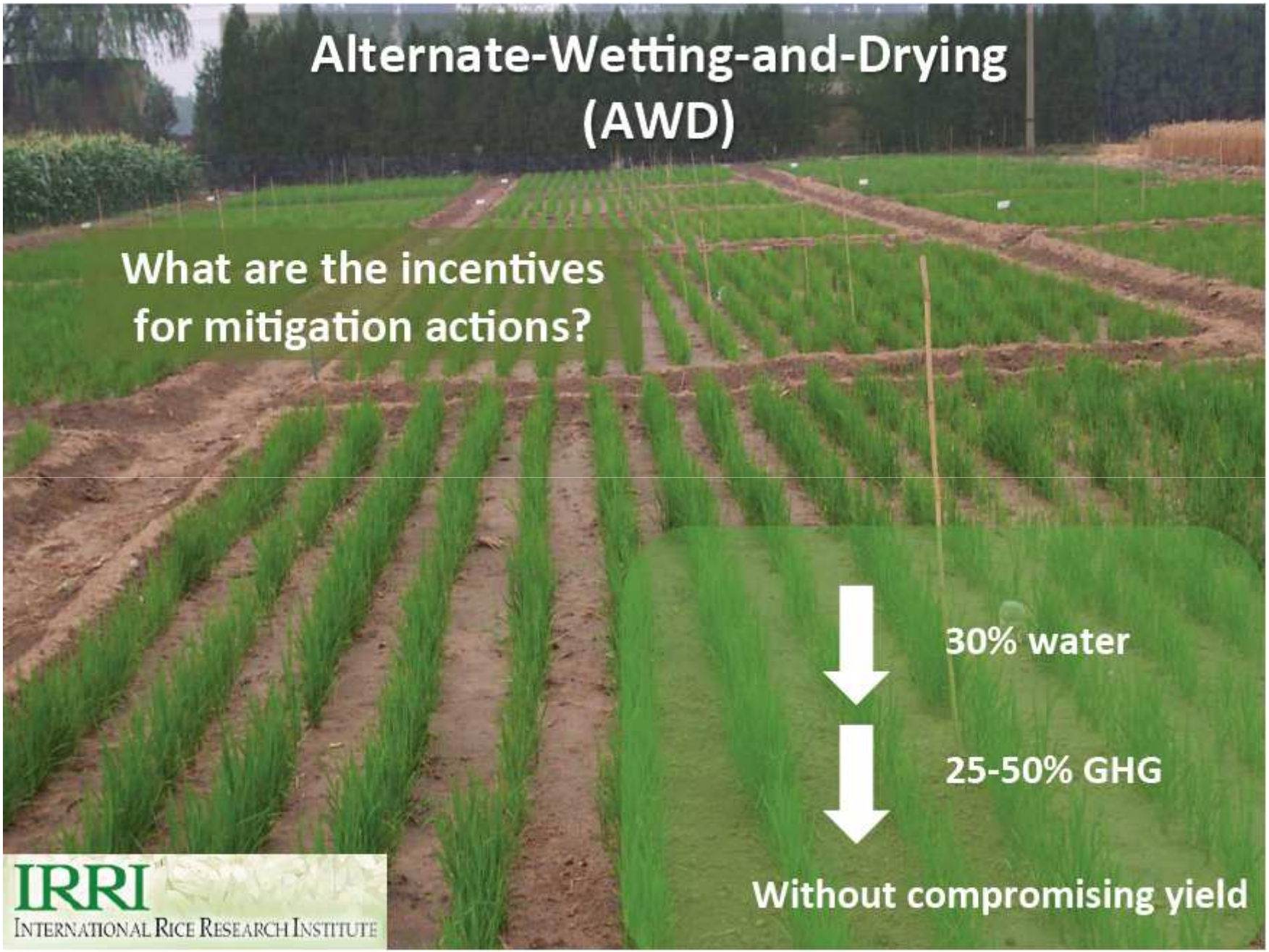
Agroforestry field in West Africa: corn and Faidherbia
« Evergreen agriculture »

Aerial view of agroforestry parkland dominated by Faidherbia in Niger (ICRAF)

Tree Cover on Agricultural Land - Global



46% of agricultural land have more than 10% tree cover
27% of agricultural land have more than 20% tree cover
15% of agricultural land have more than 30% tree cover
7.5% have more than 50% tree cover (Zomer et al, 2009)


Alternate-Wetting-and-Drying (AWD)
What are the incentives for mitigation actions?
30% water
25-50% GHG
Without compromising yield
IRRI
INTERNATIONAL RICE RESEARCH INSTITUTE

Climate Smart Agriculture at work
Conservation agriculture

Three basic technical principles:

- Permanent soil cover
- Minimal soil disturbance (zero tillage)
- Crop rotation

Triple Win

- ❑ Yields maintained for food security
- ❑ Better soil management (adaptation)
- ❑ Increased carbon in soil (mitigation)

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Intercropping: a form of conservation agriculture
based on a traditional practice - Beans and Corn (Kenya)

Five intercropping: A current situation in Africa
Banana, maize, cassava, beans, cabbage Uganda

Water Management

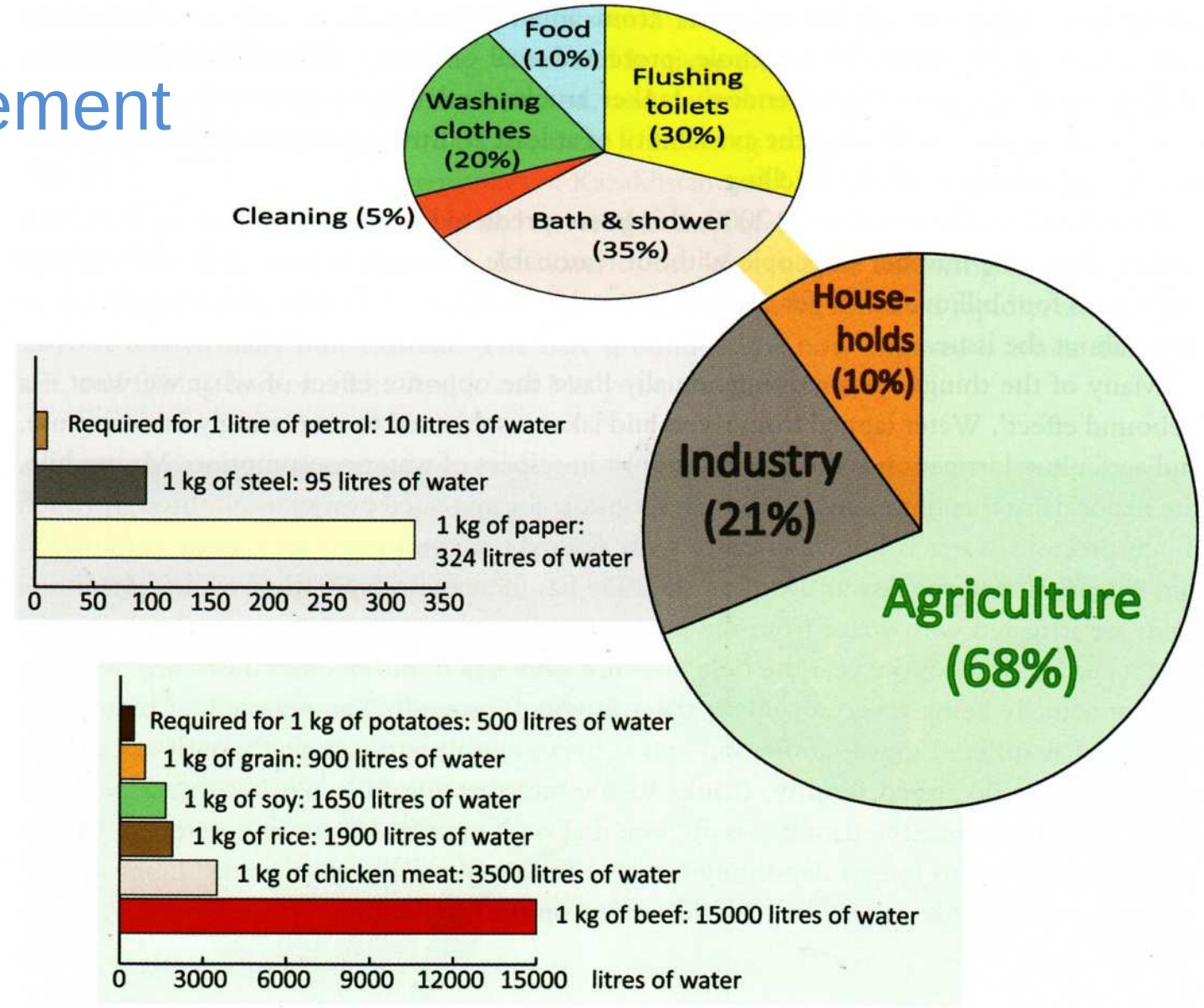
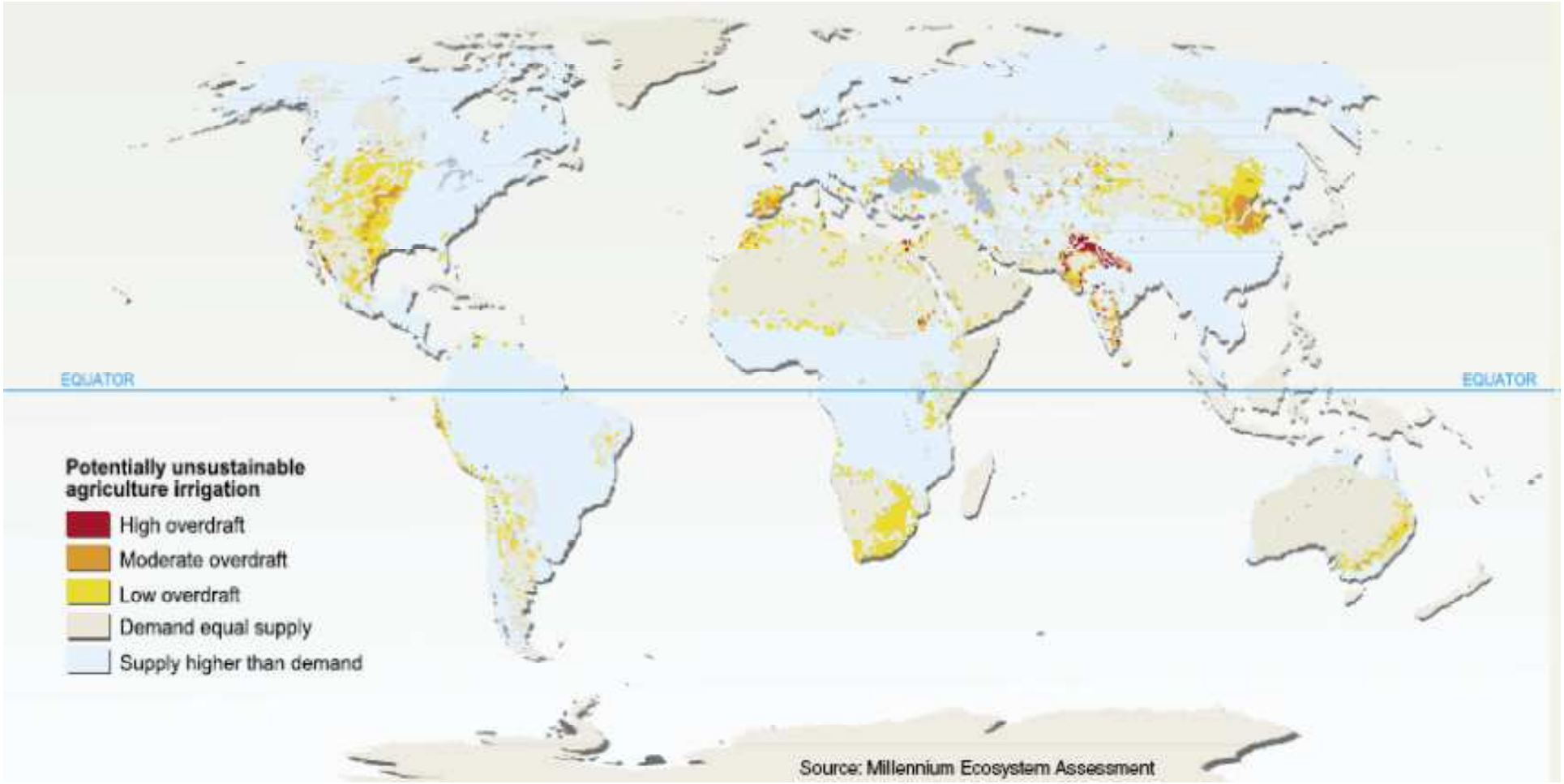


FIGURE 2.19 Clean water consumption by agriculture, industry and households, averaged out across all people. Source: Clarke and King (2004)

Appendix Figure A.3. Unsustainable Water Withdrawals for Irrigation



- **Water behind dams quadrupled since 1960**
- **3 to 6 times as much water in reservoirs as in natural rivers**
- **Water withdrawals from rivers doubled since 1960**
- **about 70% of world water use is for agriculture**